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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte DAVID L. CHAPEK

Appeal 2009-012434
Application No. 09/605,293¹
Technology Center 2800

Before MARC S. HOFF, CARLA M. KRIVAK, and
ELENI MANTIS MERCADER, *Administrative Patent Judges*.

HOFF, *Administrative Patent Judge*.

DECISION ON APPEAL

¹ The real party in interest is Micron Technology, Inc.

STATEMENT OF THE CASE

Appellant appeals under 35 U.S.C. § 134 from a Final Rejection of claims 9-12 and 14.² We have jurisdiction under 35 U.S.C. § 6(b).

We reverse.

Appellant's invention concerns a semiconductor device, variously embodied as a field effect transistor, memory array, semiconductor wafer, and thin film transistor. A layer of silicon dioxide is formed on a semiconductor substrate. The surface of the silicon dioxide layer has been doped by hydrogen ions deposited by a Plasma Source Ion Implantation (PSII) process, wherein the layer has reduced sputtered metal contaminants in comparison with a layer of silicon dioxide doped with ions deposited by a Kauffman ion implantation process. (Spec. 10-11).

Claim 9 is exemplary of the claims on appeal:

9. A semiconductor device precursor comprising:
 - a semiconductor substrate;
 - a layer of silicon dioxide formed on said semiconductor substrate, the surface of said layer of silicon dioxide having been doped with hydrogen ions deposited by a plasma source ion implantation process, wherein said layer of silicon dioxide has reduced sputtered metal contaminants in comparison with a layer of silicon dioxide doped with ions deposited by a Kauffman ion implantation process; and
 - a layer of polycrystalline silicon formed on said layer of silicon dioxide, said layer of polycrystalline silicon having a smooth morphology.

The Examiner relies upon the following prior art in rejecting the claims on appeal:

² Claims 1-8 and 13 have been cancelled.

Murata	U.S. 5,576,229	Nov. 19, 1996
Shufflebotham	U.S. 5,711,998	Jan. 27, 1998
Zhang	U.S. 5,946,585	Aug. 31, 1999
Nakanishi	U.S. 6,265,247 B1	July 24, 2001

STANLEY G. BURNS & PAUL R. BOND, PRINCIPLES OF ELECTRONIC CIRCUITS, 380-81 (1987) (“Burns”).

Claims 9-12 and 14 stand rejected under 35 U.S.C. § 112, second paragraph, as failing to particularly point out and distinctly claim the subject matter that Appellant regards as his invention.

Claim 9 stands rejected under 35 U.S.C. § 102 (a) as being anticipated by Appellant’s Admitted Prior Art (APA).

Claims 9 and 10 stand rejected under 35 U.S.C. § 102 (b) as being anticipated by Zhang.³

Claim 14 stands rejected under 35 U.S.C. § 102 (b) as being anticipated by Shufflebotham.

Claims 10-12 stand rejected under 35 U.S.C. § 103 (a) as being unpatentable over Burns in view of APA.

Claim 14 stands rejected under 35 U.S.C. § 103 (a) as being unpatentable over Murata in view of APA.

Throughout this decision, we make reference to the Appeal Brief (“App. Br.,” filed December 8, 2008), the Reply Brief (“Reply Br.,” filed May 14, 2009), and the Examiner’s Answer (“Ans.,” mailed March 17, 2009) for their respective details.

³ As evidenced by Nakanishi.

ISSUES

With respect to the § 112 rejection, Appellant argues, *inter alia*, that claims 9-12 and 14 are not indefinite because “Kauffman ion implantation is a known technique that produces known and measurable levels of metal contamination on the surfaces of target objects.” (App. Br. 6). Thus, the claimed silicon dioxide layer simply has reduced sputtered metal contamination compared to that known technique. (*Id.*). Appellant further argues that claim 14 is not indefinite because “silicon dioxide, quartz, and glass” are known materials used to form semiconductor substrates. (*Id.* at 8).

With respect to the § 102 rejection over APA, Appellant disputes the Examiner’s finding that a reduced level of sputtered metal contaminants is inherently taught by the APA’s disclosure of the Kauffman ion implantation process. (App. Br. 9-10).

With respect to the § 102 rejection over Zhang, the Examiner finds that since Zhang does not use Kauffman ion implantation, Zhang inherently has reduced sputtered metal contaminants compared with a Kauffman process. Appellant disagrees, and argues that neither Zhang nor Nakanishi teaches a layer of silicon dioxide, the surface of which is doped with hydrogen ions deposited by a PSII process. (App. Br. 11-12).

With respect to the § 102 rejection over Shufflebotham, Appellant argues that the Examiner erred in finding that Shufflebotham inherently teaches that “at least some” hydrogen ions would reach substrate 301. (App. Br. 13-14).

With respect to the § 103 rejections, Appellant again argues that the Examiner erred in finding that APA inherently teaches a reduced level of

sputtered metal contaminants compared with a Kauffman ion implantation process. (App. Br. 14-15). This presents the same issue raised with respect to the § 102 rejection of claim 9 under APA.

Appellant's contentions present us with the following issues:

1. Is the claimed recitation of "reduced sputtered metal contaminants in comparison with a layer of silicon dioxide doped with ions deposited by a Kauffman ion implantation process" (claim 9) indefinite within the meaning of 35 U.S.C. § 112, second paragraph?

2. Is claim 14 indefinite due to its recitation of "silicon dioxide, quartz, and glass" as alternative materials for a semiconductor substrate?

3. Does APA inherently teach "reduced sputtered metal contaminants in comparison with a layer of silicon dioxide doped with ions deposited by a Kauffman ion implantation process" (claim 9)?

4. Does Zhang inherently teach "reduced sputtered metal contaminants in comparison with a layer of silicon dioxide doped with ions deposited by a Kauffman ion implantation process" (claim 9)?

5. Does Shufflebotham inherently teach that at least some hydrogen ions would implant in substrate 301?

FINDINGS OF FACT

Appellant's Specification

1. Appellant admits that Kauffman ion implantation is known in the art: "[t]he silicon dioxide is pretreated by ion beam bombardment by a Kaufman ion source. Hydrogen ion beam pretreatment is typically performed using a Kaufman ion beam source directed normally to the

substrate. A Kaufman ion source employs a metal grid to accelerate ions at a particular target.” (Spec. 1:15-18).

Shufflebotham

2. Shufflebotham teaches that “the active species [i.e., hydrogen ions] migrate through the layered stack . . . and reach the poly-Si in source **306A**, drain **306B**, and channel **307**.” (Col. 6, ll. 46-49).

PRINCIPLES OF LAW

“It is well settled that a prior art reference may anticipate when the claim limitations not expressly found in that reference are nonetheless inherent in it. Under the principles of inherency, if the prior art necessarily functions in accordance with, or includes, the claimed limitations, it anticipates.” *In re Cruciferous Sprout Litig.*, 301 F.3d 1343, 1349 (Fed. Cir. 2002) (citations and internal quotation marks omitted). “Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.” *In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999) (citations and internal quotation marks omitted).

ANALYSIS

§ 112, SECOND PARAGRAPH REJECTION

We disagree with the Examiner’s conclusion that the limitation “has reduced sputtered metal contaminants in comparison with a layer of silicon dioxide doped with ions deposited by a Kauffman ion implantation process” (claim 1) is indefinite. We agree with Appellant that “Kauffman ion implantation is a known technique that produces known and measurable

levels of metal contamination on the surfaces of target objects.” (App. Br. 6). The person having ordinary skill in the art would understand that the claim calls for a reduced level of contaminants as compared with those known and measurable levels.

We further agree with Appellants that claim 14’s recitation of a semiconductor substrate formed from “the group consisting of silicon dioxide, quartz and glass” is not indefinite (App. Br. 8). We agree that such materials are commonly used to form the substrate on which a semiconductor device is fabricated (*id.*).

We conclude that the Examiner erred in holding claims 9-12 and 14 to be indefinite under 35 U.S.C. § 112, second paragraph. We do not sustain the rejection.

SECTION 102 REJECTION OF CLAIM 9 OVER APA

We disagree with the Examiner’s finding that the claimed “reduced sputtered metal contaminants . . .” are inherent in the APA.

The Examiner characterizes page 1 of Appellant’s Specification as admitted prior art: “[t]he Silicon dioxide is pretreated by ion beam bombardment by a Kaufman ion source. Hydrogen ion beam pretreatment is typically performed using a Kaufman ion beam source directed normally to the substrate. A Kaufman ion source employs a metal grid to accelerate ions at a particular target.” (FF 1). That is, the APA employs the same Kauffman ion implantation process recited in the claims. The Examiner nonetheless finds that “[t]he level of metal contaminants imparted by the Kauffman ion implantation process of the APA can be considered ‘reduced’ compared to an arbitrary ion implantation process conducted at a higher energy and/or for a longer time.” (Ans. 6-7).

The Examiner's finding does not comply with the requirements for inherency. Even if it is *possible* to vary the parameters of Kauffman ion implantation, the Examiner has failed to demonstrate that, given the teachings of the APA, it is *necessarily* true that those varied parameters would produce reduced contaminants compared with the amount of contaminants resulting from the APA. *See Robertson*, 169 F.3d at 745. It is in fact logically impossible for the Examiner to so demonstrate.

The Examiner has not established that the APA teaches all the limitations of claim 9. Accordingly, we will not sustain the Examiner's § 102 rejection over APA.

SECTION 102 REJECTION OF CLAIMS 9 AND 10 OVER ZHANG⁴

Although we agree with the Examiner that “[t]he limitation ‘having been doped with hydrogen ions deposited by a plasma source ion implantation process’ is merely a product-by-process limitation that does not structurally distinguish the claimed invention over the prior art” (Ans. 7), we do not agree with the Examiner's finding of anticipation.

The Examiner states that because Zhang does not use Kauffman ion implantation, Zhang would *inherently* have reduced sputtered metal contaminants in comparison with the prior art Kauffman ion implantation process. (Ans. 20). The Examiner provides no evidentiary support for this assertion, however. The mere probability or possibility that Zhang would have reduced sputtered metal contaminants compared to the Kauffman process is not sufficient for a finding of inherency. *See Robertson*, 169 F.3d at 745.

⁴ As evidenced by Nakanishi.

The Examiner has not established that Zhang teaches all the limitations of claims 9 and 10. Accordingly, we will not sustain the Examiner's § 102 rejection.

SECTION 102 REJECTION OF CLAIM 14

We do not agree with the Examiner's finding that, in Shufflebotham, "it is inherent that at least some hydrogen ions reach the substrate while migrating toward the chuck" (Ans. 23).

As the Examiner notes, Shufflebotham teaches "performing a hydrogenation process in which hydrogen ions diffuse into the polycrystalline silicon layer" (Ans. 23, citing Shufflebotham col. 6, ll. 17-49). Shufflebotham teaches that "the active species [i.e., hydrogen ions] migrate through the layered stack . . . and reach the poly-Si in source **306A**, drain **306B**, and channel **307**" (FF 2). Shufflebotham consequently does *not* teach that hydrogen ions reach substrate 301, located directly beneath source 306A, drain 306B, and channel 307 (Fig. 3). The Examiner's continued *insistence* that hydrogen ions would reach the substrate is no substitute for actual evidence that such a thing would necessarily occur.

Since the Examiner has not supplied any such evidence, we find that the Examiner has not established that Shufflebotham teaches a semiconductor substrate having hydrogen ions therein, as claim 14 requires. Accordingly, we will not sustain the Examiner's § 102 rejection of claim 14 as being anticipated by Shufflebotham.

SECTION 103 REJECTION OF CLAIMS 10-12 AND 14

In rejecting these claims, the Examiner again relies on the argument that "[t]he APA as discussed above inherently teaches the silicon dioxide 'has reduced sputter (sic) metal contaminants in comparison with a layer of

silicon dioxide doped with ions deposited by a Kauffman ion implantation process” (Ans. 10). We do not agree with the Examiner’s finding of inherency for the reasons given *supra* with respect to the § 102 rejection of claim 9.

The Examiner’s applied combination of references and admitted prior art fails to teach all the limitations of claims 10-12 and 14. We will not sustain the Examiner’s § 103 rejections.

CONCLUSIONS

1. The claimed recitation of “reduced sputtered metal contaminants in comparison with a layer of silicon dioxide doped with ions deposited by a Kauffman ion implantation process” (claim 9) is not indefinite within the meaning of 35 U.S.C. § 112, second paragraph.

2. Claim 14 is not indefinite due to its recitation of “silicon dioxide, quartz, and glass” as alternative materials for a semiconductor substrate.

3. APA does not inherently teach “reduced sputtered metal contaminants in comparison with a layer of silicon dioxide doped with ions deposited by a Kauffman ion implantation process” (claim 9).

4. Zhang does not inherently teach “reduced sputtered metal contaminants in comparison with a layer of silicon dioxide doped with ions deposited by a Kauffman ion implantation process” (claim 9).

5. Shufflebotham does not inherently teach that at least some hydrogen ions would implant in substrate 301.

ORDER

The Examiner’s rejection of claims 9-12 and 14 is reversed.

REVERSED

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